CSE574 Introduction to Machine Learning

Jue Guo

Alternative View of Logistic Regression

Support Vector Machine

CSE574 Introduction to Machine Learning Support Vector Machine

Jue Guo

University at Buffalo

January 28, 2024

Outline

CSE574 Introduction to Machine Learning

Jue Guo

Alternative View of Logistic Regression

Support Vector Machine 1 Alternative View of Logistic Regression

2 Support Vector Machine

Alternative View of Logistic Regression

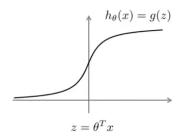
CSE574

Introduction to Machine Learning

Alternative View of Logistic Regression

Support Vector Machine A quick review: $h_{\theta}(x) = \frac{1}{1+e^{-\theta^T x}}$

- if y = 1, we want $h_{\theta}(x) \approx 1$, $\theta^T x \gg 0$
- if y = 0, we want $h_{\theta}(x) \approx 0$, $\theta^T x \ll 0$



The cost of a single example:

$$- (y \log h_{\theta}(x) + (1 - y) \log (1 - h_{\theta}(x)))$$

$$= - y \log \frac{1}{1 + e^{-\theta^{T}x}} - (1 - y) \log \left(1 - \frac{1}{1 + e^{-\theta^{T}x}}\right)$$

CSE574

Introduction to Machine Learning

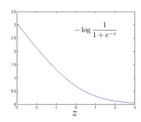
Jue Guo

Alternative View of Logistic Regression

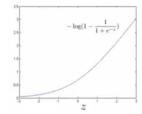
Vector Machine

$$-y \log \frac{1}{1 + e^{-\theta^T x}} - (1 - y) \log \left(1 - \frac{1}{1 + e^{-\theta^T x}}\right)$$

if
$$y = 1$$
 (want $\theta^T x \gg 0$)



if
$$y = 0$$
 (want $\theta^T x \ll 0$)



Support Vector Machine

Cost Function of Logistic Regression

$$\min_{\theta} \frac{1}{m} \left[\sum_{i=1}^{m} y^{(i)} \left(-\log h_{\theta} \left(x^{(i)} \right) \right) + \left(1 - y^{(i)} \right) \left(-\log \left(1 - h_{\theta} \left(x^{(i)} \right) \right) \right) \right] + \frac{\lambda}{2m} \sum_{j=1}^{n} \theta_{j}^{2}$$

Cost Function of Support Vector Machine

$$\min_{\theta} C \sum_{i=1}^{m} \left[y^{(i)} \operatorname{cost}_{1} \left(\theta^{\mathsf{T}} x^{(i)} \right) + \left(1 - y^{(i)} \right) \operatorname{cost}_{0} \left(\theta^{\mathsf{T}} x^{(i)} \right) \right] + \frac{1}{2} \sum_{i=1}^{n} \theta_{j}^{2}$$

Large Margin Intuition

CSE574

Introduction to Machine Learning

Jue Gu

View of Logistic Regression

Support Vector Machine

Support Vector Machine

$$\min_{\theta} C \sum_{i=1}^{m} \left[y^{(i)} \cot_{1} \left(\theta^{T} x^{(i)} \right) + \left(1 - y^{(i)} \right) \cot_{0} \left(\theta^{T} x^{(i)} \right) \right] + \frac{1}{2} \sum_{i=1}^{n} \theta_{j}^{2}$$

CSE574 Introduction to Machine Learning

Jue Guo

View of Logistic

Support Vector Machine

Questions?